Insights from international innovation support programs:
A conceptual framework and lessons from experience

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Contents

Executive Summary

There is an increasing interest in official development assistance (ODA) to help strengthen the capacity of partner countries to deploy science, technology and other sources of knowledge and innovation to achieve economic and social development goals through innovation. These innovation support programs recognise the systemic nature of innovation capacity and are guided by the innovation system concept as the key policy and capacity strengthening framework.

This report explores lessons from international experiences of designing and implementing innovation support programs. It does this as a contribution to the design of a second phase of the Aus4Innovation (A4I) program, a flagship investment by the Australian Department of Foreign Affairs and Trade (DFAT) under the Vietnam-Australia Innovation Partnership. Specifically, the study seeks to help articulate the strategic intent and implementation logic of this type of innovation support program, calibrate impact aspirations, and suggest key design principles. This report provides a framework for exploring lessons from innovation support practice and a synthesis of the finding of four reviews of international program experience that are presented in full in Volume 2:

1. International overview of development agencies' support for innovation
2. Vietnam's history and experience with innovation support programs
3. Australian international innovation support programs (focussed on innovation support outside of traditional ODA)
4. CSIRO's involvement in international projects supporting innovation

Clarifying the meaning of innovation capacity

Clarity on the nature of innovation capacity is an important anchoring of this report. It includes research and development (R&D) and technological capabilities in research organisations and firms and the capability of individuals and organisations to seek out ideas and adapt them to create value. However, other elements are also critical including: policies and regulations that provide incentives for innovation; visons and strategies to help coordinate investments and incentives to promote innovation and direct it at different impact targets; the networks and patterns of interaction that connect ideas and technologies with users and that support continuous learning and dynamic skill development; and, critically, it involves a raft of institutions – habits, practices, norms, organisational policies and routines – that pattern the behaviour of innovation actors.

Framing insights from international experiences

An initial scan of the types of innovation support programs revealed that a large diversity of approaches exists, each focusing on different facets of innovation system development. To aid analysis, it was necessary to categorise these different types of intervention to help calibrate their success in addressing different dimensions of innovation capacity strengthening. This was approached in a two-step process. First, an *innovation system failures* framework was developed to map the different types of weakness and innovation capacity strengthening needs. This framework highlights five domains of innovation system failure: (i) Institutional; (ii) Interaction; (iii) Capability; (iv) Infrastructure and resources; and (v) Systems failures.

The second step was to develop a framework that builds on the failures framework to categorise different types of innovation support program and to guide selection of case studies for in-depth analysis. The framework elaborates and extends the categories of innovation support program developed by the International Development Innovation Alliance (IDIA) (2021). It categorises six broad types of program design and impact intent:

1. **Entrepreneurial-oriented:** Supporting entrepreneurship as a foundation of broader social and economic growth
2. **Innovation process-oriented**: Supporting the capacity of the innovation systems as a foundation for broader social and economic growth
3. **Policy-oriented**: Supporting the development of effective innovation policy settings as a foundation for broader social and economic growth, but increasingly targeting better alignment with inclusive and sustainable growth and development strategies
4. **Multi-level/portfolio-oriented**: Supporting the systemic development of innovation capacity as a foundation for broader social and economic growth but can be targeted at specific development impacts such as women's health, resilience etc, through the targeting of bounded themes
5. **Deploying new platform technology-oriented:** Supporting the development of technological capability, often targeted in the service of defined social, economic and environmental impact objectives
6. **Mission-oriented:** Supporting the development of capacity for mission directed innovation, targeted in the service of defined social, economic and environment objectives.

Innovation support program modalities: strengths and trade-offs

The complexity of an innovation capacity agenda has meant that there is significant heterogeneity in the bilateral and multilateral agencies that have approached the task. There has often been an evolution and sequencing of program types over many years. In the more mature ODA donors this is often a progression from a policy focus to an innovation action orientation, but structured as part of a larger policy learning process. A more recent trend has been to focus on more entrepreneurial focused programming with an 'ecosystem' framing or, alternatively, a tightly defined mission orientation. This reflects the desire of donors to fund more bounded activities with tangible outcomes and impact achievable during the lifetime of the program. In part, this is a response to the extended time frames and unpredictable impact pathways of more systemically focused innovation support approaches such as the policy-oriented or multi-dimensional/portfolio approaches. Yet, just as the more systemic approaches have trade-offs, there are also consequences of choosing more bounded approaches.

Entrepreneurial-oriented programs

Strengths: Tightly bounded with tangible and 'measurable' outcome ambitions, this type of program is well suited to short term funding.

Trade-offs: Business led growth is unlikely to drive innovation that supports inclusion and sustainability ambitions without explicit policy and regulatory support. Entrepreneurial ecosystem framing weakens the ability to catalyse more systemic forms of innovation capacity.

Innovation process-oriented programs

Strengths: The explicit systemic framing of these approaches recognises that, while innovation action is always going to be centred on businesses and communities, innovation also needs to be supported by a wider enabling environment (policies and institutions), a set of innovation-oriented capabilities and the development of long-term relationships between partners.

Trade-offs: A tendency to focus on a specific set of innovation relationships, such as university-industry partnerships, rarely reflects the 'national style of innovation' in the emerging economies where the more usual approach involves reworking the existing stock. Alternatively, programs

spread themselves too thinly and fail to gain traction and support to sustain efforts when project support is withdrawn. Generic capacity outcomes across multiple sectors are difficult to track in the short term, and often two or three program cycles are needed to see impacts.

Policy-oriented programs

Strengths: Particularly powerful at key policy inflection points: for example, the reorientation from science and technology policy to science, technology **and** innovation (STI) policy; or the need to reorientate innovation to deal with new platform technologies, such as biotechnology or industry 4.0.

Trade-offs: Can suffer from normative, blueprint approaches to introducing new innovation policy frameworks developed in the Global North, rather than a more contextualised approach to innovation policy development. Outcomes and impacts are highly uncertain and unpredictable, often due to underdeveloped policy implementation capacity. Policy-oriented programs fail when insufficient attention is given to local policy analysis and formulation capability and where inappropriate international expertise is brought in.

Multi-level/portfolio-oriented programs

Strengths: Applies a whole of innovation system approach, with a practice-to-policy scope of capacity building, and an explicit learning orientation.

Trade-offs: Risk of spreading resources too thinly, resulting in program fragmentation with many small-scale activities failing to trigger wider systemic changes. It also poses challenges for monitoring and evaluation (M&E) because of the intangibility of outcomes and the unpredictability and long-term nature of impact pathways. Requires long-term donor commitment.

Deploying new platform technology-oriented programs

Strengths: Developing technological capability across firms, R&D organisations and relevant policy domains is a key element of economic development strategies.

Trade-offs: This is a large scale and often decades long capacity development task. Policy support has been a valuable entry point, but most useful when followed up with more innovation action-oriented programs. Like other approaches, a clear thematic focus with strong policy visibility is a useful way of concentrating support resources and delivering tangible results within program cycles.

Mission-oriented programs

Strengths: Embodies much of current thinking on focusing innovation on societal scale development aspirations that are complex in nature and require social and technical innovation. The more successful programs have been those that are designed as policy facing dialogue platforms that commissions scoping studies and set up experiments to test solutions and learn from them.

Trade-offs: Thematic hubs sometimes overly focus on technology acceleration and commercialisation through an entrepreneurial ecosystem lens. This tends to overlook the role of social innovation in addressing societal grand challenges and pays less attention to policy engagement and the need for institutional and policy reform needed to enact and scale socio-technical change.

The forward innovation support agenda

Considering the insights from this review of international experience of initiatives to strengthen innovation (and entrepreneurial) systems, and the innovation-related challenges that emerging economies are likely to face over the next 20 years, a set of nine inter-related principles for innovation system strengthening and transformation emerge:

1. **Planning to Learn:** Innovation projects must be designed and developed in a context of complexity, uncertainty and multiple system failures. Detailed *a priori* planning must give way to an active learning approach.
2. **An Evolving Theory of Change:** A theory of change (ToC) makes explicit the assumptions that shape the initial approach and the decisions regarding scope, participants, objectives etc. Developed collaboratively, it forms the initial basis of shared views of the situation, the challenges and the approach to change. The process of developing and reviewing the ToC is a key aspect of learning.
3. **Adaptive Management:** A planning approach and the use of an evolving ToC means that detailed pre-project planning is not appropriate. An adaptive management approach is needed. This has challenging implications for staffing, budgeting and accountability, as project managers must respond effectively to contingencies and emerging opportunities.
4. **Policy Experiments:** In the context of innovation and innovation policy, change involves experiment. Managed experiments, robust evaluation and openness to learning builds knowledge, capability and confidence.
5. **Organisational and Institutional Innovation:** Technologies, organisations and institutions (in the sense of rules, conventions, policies, cultural norms) co-evolve. The lack of organisational and institutional innovation is often what blocks or reduces the returns to and incentive for technological change. Untethering perceptions of innovation from a fixation with technology can be a step toward empowering organisational and institutional innovation.
6. **Endogenous Drivers:** Innovation system formation, growth and change is an endogenous process. The primary objective of an intervention to support innovation systems strengthening is to develop the agency of the participants, particularly those with the least agency, and to grow the level of endogenous change momentum and capability.
7. **Entrepreneurship:** Entrepreneurship in all its forms – leading the formation of new for-profit or social enterprises and the formation or transformation of organisations and policies – is a form of (business, social, organisational, institutional) experiment and a critical driver of change.
8. **Sustained Engagement:** Another implication of this approach to innovation support is that the key processes of capability building, alignment of interests, trust building, discovery of opportunity, etc. are likely to require sustained support over perhaps long time periods.
9. **Transformational change and the directionality of innovation:** Societal-level challenges, such as climate change, environmental sustainability and inclusive growth, demand transformational change processes affecting all dimensions of societies and economies in order to reorientate innovation to these new goals. Periods of transformational change involve substantial economic and social disruption, with skewed distributions of costs and benefits. What is new is that the perspective through which analysts, and to some extent governments, frame policies for transformational change is now an innovation systems perspective. Hence, the directionality of innovation system evolution is seen as an explicit policy issue, rather than the 'natural' outcome

of market forces.[1] The United Nations Sustainable Development Goals (SDGs), for example, aim to set a normative direction for policy, including innovation policy. Innovation system strengthening strategies that combine mission-oriented innovation policies might also provide an approach to directionality.

Design lessons for A4I phase 2

It is important to correctly frame the task of innovation support as a systemic challenge and be clear on the implementation and impact logic that flows from this: It is important that key program staff and stakeholders are adequately socialised with the underlying ToC implied by a systemic understanding of innovation capacity and the logic that links individual program activities with broader program goals and objectives of systemic capacity development.

Choices have consequences and these need to be made transparent: Different program modality choices have impact and resource consequences and trade-offs in terms of long- and short-term results, and in terms of sustainability of the capacity built. It is important to be transparent about these consequences and trade-offs in negotiations with host country partners and donors.

Program design needs to be firmly rooted and informed by national contexts: The need for collaborative program design with national partners and strong alignment to policy and development priorities requires a deep understanding of existing modes/national styles of innovation and the specific challenges (but also opportunities) that emanate from it. This implies avoiding normative assumptions and instead targeting innovation capacity support aligned to both to national development priorities as well as building on existing modes of innovation in a particular country setting. This needs to be reflected in the composition and role of governance and program advisory committees to help anchor program directions cognisant of a range of contextual issues that shape the national innovation style and agenda.

Programmes with an innovation agenda that is framed by impact aspirations rather than technology offerings gain more policy traction: While new platform technologies present specific technological capability building challenges, for the most part, innovation support needs to be framed by impact challenges that may be agnostic to the forms of knowledge, technology and innovation that are mobilised to address these challenges. However, impact challenges need to be carefully chosen with a realistic scale of ambition, but at a scale of sufficient significance to act as a policy exemplar.

It is important to recognise that innovation is most usually driven by the ability of firms and others to rework the existing stock of knowledge rather than R&D as a source of useful knowledge: Research and technology commercialisation plays a relatively minor role in innovation in partner countries. More emphasis is needed on supporting existing modes of knowledge acquisition and adaptation. This could be a steppingstone to building industry capability to demand and use knowledge from formal R&D organisations.

Building explicit links between innovation interventions at the firm or community level and the broader policy learning process strengthens the overall national capacity for innovation: A policy experimentation modality supported by evaluation and learning and explicit policy dialogue processes helps build knowledge, capability and confidence, and strengthens the overall national capacity for innovation by adapting the policy enabling environment to emerging innovation opportunities and modalities.

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[1] For example: Schot, J., Daniels, C., Torrens, J. and Bloomfield, G., 2017. Developing a shared understanding of transformative innovation policy. TIPC Research Brief, 1.

A focus on building capability in innovation policy evaluation and formulation strengthens policy learning: The ability to evaluate the effectiveness of different policy instruments is critical to a policy learning process that continuously adapts the capacity of the innovation system to current and future impact challenges.

Selecting the right thematic focus helps focus resources and gain policy attention: Giving a thematic bounding to an innovation support program not only concentrates scare resources, but also helps interventions develop a proof of concept in a specific domain. Providing tangible impact results is a way of gaining policy attention that may be required for broader diffusion and scaling of the initiative. Appropriate themes are those framed by development impact challenges and these need to be identified in consultation with national prioritisation processes.

Bringing in high quality expertise and new ideas helps introduce new ideas about innovation: Successful programs are often those where the calibre and reputation of the international partners has been such that it has introduced radical new ways of thinking about innovation. Designing programs so that there is a creative tension between existing innovation thinking in a country and new ideas brought in from outside aligns with an overall ethos of experimentation and learning in these projects.

Flexibility, process driven, adaptive management approaches balanced with an impact focus helps programmes achieve goals: The process of innovation capacity building is not a linear one that can be planned and engineered in advance. ToCs and program logics need to be adapted to the experimental nature of the task. At the same time, individual sub-projects on their own are unlikely to make substantial inroads in the innovation capacity building challenge or the impact issues that these are focused on. Taking an active portfolio management approach is thus important in terms of tracking program outcomes and impacts and adapting investments strategies along the way. This implies much greater attention to the MEL process and function it plays within program implementation.

1 Introduction

Support for innovation over the past 20 years has become a growing component of the programs and strategies of many international development agencies. In recent years, the emphasis of innovation support programs has shifted in focus from the transfer of solution artifacts (e.g., introducing new crop varieties, putting in place market and industry infrastructure) to a focus on helping countries and their citizens shape and manage their own innovation journey. What makes innovation support programs different is the explicit focus on capacity strengthening – specifically, strengthening the capacity of sectors, regions, or nations to deploy science, technology and other sources of knowledge and innovation to achieve economic and social development goals through innovation. Typically, these programs are premised on an understanding of the systemic nature of innovation capacity and are guided by the innovation system concept as the key policy and capacity strengthening framework.

Innovation support programs are a relatively new mode of international development assistance for Australia. The flagship investment under the Vietnam-Australia Innovation Partnership, the A4I program, after 24 months of delivery, is evaluating program progress and lessons against other international experience. The genesis of this study was a need for A4I to fill a knowledge gap by situating its experience in the wider context of practice and thinking in the international innovation capacity support domain. An important aim of the study is to provide insights from wider international experience to inform the design of phase 2 of the program, helping articulate its strategic intent and implementation logic, calibrate its impact aspirations and improve its overall design. This study will also help guide the design of future innovation support programs in the Asia-Pacific.

The study commissioned four mainly desk based reviews of different dimensions of international innovation support programs (the reviews are presented in full in Volume 2). These were predominantly focused on the experiences of bilateral and multi-lateral international agencies. Two very broad observations emerge from the study. First, there is a significant degree of convergence of high-level findings across the four studies. Second, the evaluation of these programs remains a significant challenge because of the intangibility of capacity strengthening outcomes, the long time frames involved in achieving impacts and the difficulty of establishing a clear line of sight between program activities and eventual impacts. This was an important issue for the study, as it was based on review on existing evaluations. Despite this challenge, this report provides actionable recommendations based on firm evidence emerging from a comprehensive review of existing analysis and evaluation.

Section 2 of this report introduces the methodology. Section 3 introduces the concept of innovation and a rationale for innovation support programs. Section 4 provides frameworks for the analysis of innovation support programs, including descriptions and categories of different innovation support programs. Section 5 introduces the current landscape of innovation systems supports from an international, Vietnamese and Australian perspective and introduces the four studies and their case studies (further detail of each is in Volume 2).

Section 6 and Section 7 draw on the previous sections to discuss the key insights and lessons from international experience. In Section 8, broad principles are identified for the design of initiatives aiming to strengthen innovation systems in developing countries.

2 Methodology

Support for innovation has become a growing component of the programs and strategies of most ODA. This report provides an overview of the development of innovation support over the past 20 years through four review studies (presented in full in Volume 2):

1. International overview of development agencies' support for innovation
2. Vietnam's history and experience with innovation support programs
3. Australian international innovation support programs (focussed on innovation support outside of traditional ODA)
4. CSIRO's involvement in international projects supporting innovation

Approaches to supporting innovation vary widely. The report explores the types of programs that have been undertaken and presents a framework of the most common models and exemplar case studies.

The four studies focus on the question: What can we learn from the diverse international experience of innovation systems strengthening programs to inform their design and management?

To address this question, the authors undertook desktop studies to review the available literature and grey literature, evaluation reports and commissioned donor studies and supplemented this with interviews of key stakeholders responsible for the design and implementation of programs where those became case studies chosen for deeper analysis.

During the initial desktop analysis, 300+ programs or projects were gathered, assessed for relevance and used to develop the theoretical frameworks characterizing innovation system failures and major types of innovation support programs (discussed in the next section below). Eighteen case studies were developed across the four studies, exemplifying the major types of innovation support programs and seeking to understand their objectives and logics of intervention. While recognising the very limited number of systematic long-term evaluations, the reports review evidence for programs or project effectiveness in driving innovation and innovation capacity.

3 Conceptualising Innovation capacity: a rationale for innovation support programs

It could be argued that ODA has always been about innovation: introducing new crop varieties, putting in place market and industry infrastructure, supporting policy and regulatory reform – all with the intent of promoting economic growth and addressing social issues such as poverty reduction, health and education. What makes the more recent innovation support programs different is that the focus is explicitly on strengthening the capacity of sectors, regions or nations to deploy science, technology and other sources of knowledge to achieve economic and social development goals through innovation.

Box 3.1 Innovation System Definitions

The origins of the idea of a (national) system of innovation emerged from observations that rates of economic growth in some countries (notably Japan in the 1980's) had become decoupled from investments in R&D. Historically, investments in R&D were the main policy instrument and measure of a country's capacity to innovate. The observed uncoupling of R&D and growth suggested that the ability of countries to deploy innovation for economic development was related not just to the quantum of R&D, but also to the capacity of countries to manage the deployment of ideas in economically and socially productive ways. On closer inspection, it was found that this capacity was highly systemic in nature, involving dense networks of interaction across knowledge production and use nodes in the economy. Successful economies were found to be those where the national style of innovation was highly interactive in nature and where policy and institutional arrangements had encouraged the development of capabilities to access and assimilate new ideas through an evolutionary process of continuous learning and improvement. This idea of an innovation system has become the corner stone of innovation policy over the last 30 years or so. The concept has grown in nuance over this period, as the historical evolution of the definition of the concept below demonstrate.

- " .. the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies." (Freeman, 1987)
- " .. the elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge ... and are either located within or rooted inside the borders of a nation state." (Lundvall, 1992)
- "... a set of institutions whose interactions determine the innovative performance ... of national firms." (Nelson, 1993)
- " .. the national institutions, their incentive structures and their competencies, that determine the rate and direction of technological learning (or the volume and composition of change generating activities) in a country." (Patel and Pavitt, 1994)
- ".. that set of distinct institutions which jointly and individually contribute to the development and diffusion of new technologies, and which provides the framework within which governments form and implement policies to influence the innovation process. As such it is a system of interconnected institutions to create, store and transfer the knowledge, skills and artefacts which define new technologies." (Metcalfe, 1995)
- "...all important economic, social, political, organisational, institutional, and other factors that influence the development, diffusion, and use of innovations." (Edquist, 2005).
- ".. a human social network that behaves like a sociobiological system, wherein people have developed patterns of behaviour that minimise transaction costs caused by social barriers resulting from geography, lack of trust, differences in language and culture, and inefficient social networks." (Hwang and Horowitt, 2012)

In this way, innovation capacity includes R&D and technological capabilities in research organisations and firms and the capability of individuals and organisations to seek out ideas and adapt them to create value. It includes policies and regulations (including but beyond STI policy) that provide incentives to support the use and diffusion of new ideas and technologies. It includes visons and strategies to help coordinate investments and incentives to promote innovation and direct it at different impact targets. It includes the networks and patterns of interaction that connect ideas and technologies with user and that support continuous learning and dynamic skill development, and, critically, it involves a raft of institutions – habits, practices, norms, organisational policies and routines – that pattern the behaviour of innovation actors. These institutional issues operate at

individual to organisational to policy scales, and, while these are critical enablers of innovation, or may constitute critical innovations in themselves, institutional and policy issues often manifest as a barrier, particularly when taking innovation to scale.

There are some prominent (although far from unique) innovation capacity features and needs in emerging economies. These include:

- The informal sector generally plays a much larger role in the economy. This is often an important, but overlooked source of innovation. It is often poorly linked to formal sector enterprises or research activity and receives limited policy support.
- Public research organisations are often poorly integrated into relevant areas of social and economic activity. Similarly, innovation coordination or intermediation mechanisms that help connect different innovation players and marshal resources for innovation are often missing or weak.
- The capability of most firms to absorb and apply new knowledge is often weak, particularly in the SME sector, which tends to be the most common form of enterprise in emerging economies.
- Historical and structural injustices and inequities tend to weaken the capacity to direct innovation to inclusion and sustainability goals. This is exacerbated by underdeveloped governance arrangements. Enabling marginalised groups to build agency to participate in innovation system development is often a key challenge.
- Rent seeking behaviour and weak accountability institutions can remove incentives for innovation.
- STI policy formulation and evaluation capacity is often underdeveloped and frequently framed by out-of-date perspectives on the role of R&D in economic growth.

This understanding of innovation system capacity and associated, frequently encountered failures highlights that innovation is not a purely technological phenomenon driven by R&D. Rather, innovation is most usually the reworking of existing stocks of knowledge and includes organisational, institutional and policy innovation. Additionally, social innovation and informal sector innovation, particularly in the Global South, are often critical sources of creativity that occur outside the sphere of formal R&D activity and policy support.

The uncoupling of innovation from science and technology, largely as a result of the adoption of innovation system policy framing, has seen innovation become an issue of interest in an extremely broad set of policy and programming domains. Increasingly innovation is understood less in terms of the development and deployment of specific technologies (although this remains important), but more in terms of social, economic and environmental goals and the institutional and process innovations needed to mobilise technology, ideas and social and organisational designs to address these goals. This broader innovation agenda is becoming particularly important in relation to sustainability transitions and the systems transformation agenda implied by the SDGs. In this context, addressing issues such as climate change, poverty reduction, emissions reduction and inclusive economic growth demands socio-technical change, rather than a narrow focus on technological innovation alone.

4 Framing the analysis of innovation support programs

4.1 Innovation system weaknesses and failures

From the innovation system perspective, weaknesses in innovation performance are due to failures at the level of the system structure and or function, rather than (or in addition to) market failures. Cognisant of this, the authors developed a *failures* conceptual framework to help clarify the logic and strategic intent of different programming approaches.

An initial scan of the types of innovation support programs being deployed revealed that a large diversity of approaches exists, each focusing on different facets of innovation system development. To aid analysis, it was necessary to categorise these different types of intervention to help calibrate their success in addressing different dimensions of innovation capacity strengthening. This was approached in a two-step process. First, based on the conceptualisation of innovation capacity outlined in the section above, an *innovation system failures* framework was developed[2] to map the different types of weakness and innovation capacity strengthening needs. This framework highlights five domains of innovation system failure: institutional, interaction, capability, physical and financial resources failures and system or directionality failures (see Box 4.1 for summary of these types of failure and Appendix 1 for the failures framework in full).

Box 4.1 Innovation system failures

Institutional failures: Hard rules and regulations (policies) and soft rules and norms (routines, culture) that enable, shape and direct innovation activity.

Interaction and network failures: The links, interactions and cooperative relationships needed to share knowledge and resources needed for innovation between actors

Technological and business capability failures: Knowledge and skills needed to enact innovation.

Physical and financial resources failures: Infrastructure, equipment and financial capital needed for innovation

System or directionality failures: The inability of complete (social) systems to overcome path dependencies to adapt to new technological paradigms or new social and economic values such as inclusion or environmental sustainability

The second step is a framework that builds on the failures framework to categorise different types of innovation support program. This elaborates and extends the categories of innovation support program developed by the IDIA (2021). It categorises six broad types of program design and intent:

1. Entrepreneurial-oriented
2. Innovation process-oriented
3. Policy-oriented
4. Multi-level/portfolio-oriented
5. Deploying new platform technology-oriented
6. Mission-oriented.

[2] This innovation system failure framework draws on Woolthuis, R.K., Lankhuizen, M. and Gilsing, V., 2005. A system failure framework for innovation policy design. *Technovation*, *25*(6), pp.609-619.

These categories are described in the next section. It is recognised that these categories are not discreet but form a continuum. It is also recognised that some categories can be inputs in other program designs: for examples, platform technology-oriented and mission-oriented programs may include elements of entrepreneurial and innovation process program designs. These two frameworks operate as a matrix as illustrated in Table 4.1 and were used to guide the selection and analysis of case studies.

Table 4.1 Summary of study framework

	Entrepreneurial-oriented programs	Innovation process-oriented programs	Policy-oriented	Multi-level/portfolio-oriented programs	Deploying new platform technology-oriented programs	Mission-oriented programs
Institutional failures		X	X	X	X	X
Interaction failures	X	X		X		X
Capability failures	X	X	X	X	X	X
Infrastructure and Resource	X			X		
System failures					X	X

X indicates the types of innovation failure that different categories of program are addressing.

4.2 Categorising different Innovation support modalities

From the review of innovation support programs and projects, several markedly different approaches to innovation support were identified, each with specific objectives and modalities. The authors characterise six major approaches and the impact vision of these as follows:

Entrepreneurial-oriented programs

The key focus is entrepreneurial support. The logic is that entrepreneurs and their business are the innovators that launch and scale new products and services in the market. These programs target gaps and resources needed for entrepreneurship, as satisfying entrepreneurs' needs can drive innovation. This includes strengthening capabilities and skills, and financial resources and infrastructure needed for innovation. It also includes addressing missing or ineffective dimensions of the entrepreneurial ecosystem. This might concern missing actors such as venture capital and or weaknesses in the business operating environment such as regulation, legal frameworks and incentives. Capabilities need to commercialise new ideas are often a prominent feature of these programs.

Impact vision: Entrepreneurship as a foundation of broader social and economic growth.

Innovation process-oriented programs

The key focus is on helping different actors realise and fulfil their role along various stages of the innovation processes across the innovation system. The logic is that innovation emerges from the interaction of producers and users of knowledge and ideas, and that this process needs to be enabled by capabilities, communication channels and interaction opportunities, and by institutional and policy setting that incentivise and support this. These programs target partnership development, university industry relationships, innovation platforms and hubs, the translation of ideas into use, as

well as institutional and policy considerations that support interactive innovation processes (for example professional reward systems in universities, or policy instruments that encourage university industry collaboration).

Impact vision: Supporting the capacity of the innovation systems as a foundation for broader social and economic growth.

Policy-oriented programs

The key focus is strengthening innovation policy formulation and policy learning. The logic is that policy settings play a critical role in enabling the functioning of the innovation system, supporting the development of innovation capability and capacity, as well as shaping the direction of innovation through the selection of priorities aligned to national development aspirations. These programs target both policy research and a range of policy formulation tasks and capability. This can include diagnostics studies and innovation policy reviews to targeted policy development (e.g., regulation for biotechnology or intellectual policy), evaluation and impact assessments of policy interventions. It also targets policy formulation capability and innovation policy coordination through the development or strengthening of innovation councils and similar agencies. More recently, these programs have targeted helping national governments design consultation and foresighting processes to reframe innovation policy towards the SDGs.

Impact vision: effective innovation policy settings as a foundation for broader social and economic growth but increasingly targeting better alignment with inclusive and sustainable growth and development strategies.

Multi-level/portfolio-oriented programs

The key focus is integrating different forms of innovation support across different scales of the innovation system. The logic is that innovation capacity is systemic and requires issues of entrepreneurship, partnership and interaction, institutional and policy development to be tackled in an integrated fashion with strong feedback loops and iteration. These programs target different dimensions of innovation strengthening usually around bounded themes such as commercialisation, research translation or industry specific issues. Program components can include capacity building, grant schemes, venture capital challenge programs, policy research, evaluation and strategy development. The use of practical innovation use cases as a way of informing policy and institutional reform is a common characteristic.

Impact vision: Systemic development of innovation capacity as a foundation for broader social and economic growth but can be targeted at specific development impacts, such as women's health and resilience, through the targeting of bounded themes.

Deploying new platform technology-oriented programs

The key focus is building technological capability to enable the deployment of emerging platform technologies (platform technologies refer to groups of technologies that are used as a base upon which other applications, processes or technologies are developed. Examples include: biotechnology, nanotechnology, computing hardware, etc). The logic is that new platform technologies can have pervasive effects across the economy, but that this requires new technological capacities in the realm of both R&D and entrepreneurship as a suite of policies and regulations to enable its use and to avoid perverse or negative social and environmental consequences. These programs focus on building technological capability on a specific new platform technology in research, business and policy organisations. Programs may be focused on a specific industrial sector, such as agricultural biotechnology, or may be focussed across industries, as is the case with digital transformation. The balance between building R&D and entrepreneurial capability

to deploy new technology and the development of enabling policies varies with the emphasis often shifting over time.
Impact vision: Building technological capability can be targeted in the service of defined social, economic and environment objectives.

Mission-oriented programs

The key focus is to marshal innovation capabilities, resources and actors around clearly defined and bounded challenges of high complexity and relevance to societal scale development aspiration. The logic is that existing patterns of innovation capacity, action and policy are not well aligned to the resolution of these challenges (e.g., plastic waste, climate change, water pollution) and that by focusing attention on defined challenges, technical, institutional and social solutions can be mobilised to address them. Solutions are often systemic in nature, requiring a combination of system and component innovation as well as supporting policy shifts. These programs often take the form of a thematic hub or platform or some other program device to coordinate the activities of different innovation actors and stakeholders. This often involves mobilising and adapting existing technology and expertise. It may often involve enrolling communities and informal sector players that can provide models of social innovation and solutions.

Impact vision: Building capacity for mission-directed innovation can be targeted in the service of defined social, economic and environment objectives.

In Table 4.2 we summarise the characteristics of these programs in terms of purpose, scope and intervention targets. In that table we also indicate the detailed case studies that illustrate these categories and that were explored in the four studies commissioned for this report (see Volume 2).

Table 4.2 Characteristics of the Major Types of Innovation Support Program

	Entrepreneurial-oriented	Innovation process-oriented	Policy-oriented	Multi-level/portfolio-oriented	Platform technology-oriented	Mission-oriented
Purpose	Establishing/ strengthening the enabling environment for entrepreneurship as a foundation of broader social and economic growth	Helping different actors realise and fulfil their role along various stages of the innovation processes	Strengthening innovation policy formulation and policy learning to better align with national growth and development strategies.	Strengthening innovation capabilities and enabling conditions across practice to policy scales	Building technological capability & associated networks & reorientating the enabling environment to deploy new platform technology in the service of defined social, economic & environment objectives	Mobilising specific innovation system actors, assets and innovation enabling conditions to address a shared and well-defined mission or challenge
Targeted issues	Lack of entrepreneurship culture and incentives Inadequate or missing resources/ assets Limited skills and expertise among entrepreneurs	Ineffective trust or incentives to collaborate Lack of intermediation functions Missing or inappropriate networks & patterns of collaboration	Ineffective/missing/ misaligned policy setting to enable and direct/target innovation toward national priorities	Systemic innovation failures of the innovation system	Missing or misaligned capabilities, networks, systems, infrastructure and policy and regulatory environment	Lack of prioritised agenda among actors Lack of leadership & accountability Missing incentives and enabling environment to target & collaborate on shared challenges
Scope	Usually not sector or locality specific Focused on specific needs of innovators	Often sector specific Focused on general needs of different actors	Not sector specific	Not sector-specific, but can be	Usually sector specific	Usually sector specific Usually tied to a specific geography
Typical interventions	Funding and knowledge support to entrepreneurs and incubators	Training researchers and facilitators to develop research-user links; cluster support.	Independent reviews of national STI and innovation policies	Advice and co-funding of national, regional and sectoral projects.	Training researchers, support to research & policy organisations & networks	Development of shared agendas around a specific social or other goal, e.g., a health goal.
Case Studies	• The Scaling Frontier Innovation Program	• Sida's Innovation Systems Cluster Program in East Africa	• Policy Support Programs of Multilateral Agencies	• The Inter-America Development Bank • IORA Blue Carbon Hub	• BioEARN and Bio-Innovate in East Africa	• Indonesia Australia Red Meat Cattle Partnership

	• Knowledge brokering for Pacific climate futures • Team Up • Pacific Media Assistance Scheme	• IDRC and OECD/WB STI Reviews in comparison • UNIDO policy advice to STI Strategy 2011–2020 plus The High-Tech Law Implementation	• Earth Observation for Climate Smart Innovation • SIMA Austral • Innovation Partnership Program (IPP) • Australia-India Strategic Research Fund	• SAREC funded Vietnam research programs • Indonesia-Australia Plastics Innovation Hub

5 Current Landscape of innovation support programs

5.1 Introduction

Recognition of the potential role of innovation for achieving development objectives has led to the recognition that innovations develop and evolve in complex systems, involving organisations, their relationships and the broader resource and institutional context that shapes their behaviour and the outcome of innovation efforts. However, there are several conceptual frameworks, at the micro, meso and macro level, for understanding and analysing innovation-related systems.

This systemic perspective on innovation now provides the foundation for innovation policy in most OECD countries and is increasingly influential in all countries[3]. While the perspective that had wide influence was focused on the national level, as national systems of innovation, the systems perspective has now been extended and applied at the regional and sectoral level.

Most ODA initiatives that seek to facilitate innovation system change are at the meso-level – within a geographic area or within a sector – where a limited range of actors and technologies are in scope. At this level there are a few relevant conceptual frameworks: regional innovation systems, sectoral innovation systems, entrepreneurial ecosystems and innovation ecosystems.

At the micro-level, many ODA agencies have sought to incorporate innovation in all aspects of their operation and become in some respects 'innovative organisations'. This is undoubtedly a useful development and is likely to contribute to these agencies playing a more effective role in fostering innovation support initiatives in partner countries. Whichever innovation system framework is used, it is vitally important to emphasise the systemic foundation of capability and performance and the evolutionary nature of change.

The following provides highlights from the four commissioned reviews, namely:

1. International overview of development agencies' support for innovation
2. Vietnam's history and experience with innovation support programs
3. Australian international innovation support programs (focussed on innovation support outside of traditional ODA)
4. CSIRO's involvement in international projects supporting innovation

(The full reports are presented in Volume 2 of this report)

5.2 International overview of development agencies' support for innovation

The international study reviewed existing bodies of literature that have analysed innovation support program experience globally, including meta studies by the IDIA, and undertook an in-depth exploration of five case studies that are typical of several of the major types of innovation support programs. The study highlights that there is an increasing intent globally in trying to understand how innovation support programs are operating and some of the challenges in undertaking them. The five case studies include:

[3] For example: Eklund, Magnus, 2007.Adoption of the Innovation System Concept in Sweden, Uppsala Studies in Economic History 81, Uppsala,n Sweden.

5.2.1 Innovation process support program: Sida's Innovation Systems Cluster Program in East Africa

The Sida Research Cooperation program in East Africa is one component of a broader program that is focused on cluster (also labelled Triple Helix) initiatives with universities as anchor participants. This case study focuses on the program in Tanzania and Uganda. The program began with eighty cluster initiatives in these two countries in 2006, and by 2011 there were 50 cluster initiatives. Sida expenditure over 2005–2009 was about SEK7 million (approx. USD7.7 million). The development, design and implementation of the program was underpinned by 30 years of Sida experience in East Africa and strong relationships with many of the African participants.

Its approach represented a shift in focus on the enabling environment for innovation, the innovation system, rather than on individual innovations. There was an expectation that the participation in clusters by actors from governmental agencies, private enterprises and universities would complement each other in the innovation process and also generate a co-evolutionary learning process that would mobilise the resources to spur product development, policy formulation and academic research. Facilitators, the majority of which were researchers or linked to universities, had critical roles in forming and nurturing the links and communication between cluster members.

Beyond the cluster projects, Sida enabled researchers linked to the program to participate in international networks through conferences such as Globelics, African Innovation Summit in 2018 and research studies such as UNIDEV. They also supported a "Forum on Higher Education and Research" located at UNESCO and a policy research network in Africa.

5.2.2 Entrepreneurial ecosystem development program: The Scaling Frontier Innovation (SFI) Program

The SFI Program is an initiative of DFAT's innovationXchange. The program, which involved a total investment of about AUD15 million, began in 2017 and some components will run to the end of 2021. SFI is an experimental program to test hypotheses around what types of support may scale the development impact of social enterprises in the Asia-Pacific most efficiently, effectively and sustainably. It was also experimental in working with a novel performance framework. SFI aimed to stimulate private sector contributions to help more social innovators and their social enterprises grow their reach and impact. SFI has three components which focus on different parts of the entrepreneurial ecosystem.

This innovative program has developed a strong systems approach and has worked with a performance framework incorporating social inclusion goals and lessons from prior development experience.

5.2.3 Developing capabilities in platform technologies: BioEARN and Bio-Innovate in East Africa

Sida has funded The Eastern Africa Regional Program and Research Network for Biotechnology, Biosafety and Biotechnology Policy Development (Bio-EARN) (1998–2010) and its successor program, Bioresources Innovations Network for Eastern Africa Development (Bio-Innovate Africa) (2010– 2021), each with a number of phases, and with total funding of about SEK350 million (approx. USD40 million). At the beginning of Bio-EARN, the program included Ethiopia, Kenya, Tanzania and Uganda; Burundi and Rwanda were later included. These programs have sought to enhance innovation capacity in order to provide a base for an innovation platform in a new area of science and technology.

While BioEARN significantly improved the availability of trained human resources, it also led to increased collaboration in technology development and technology transfer partnerships in 15 East

African research, development and policy institutions; increased awareness on key biotechnology policy issues; and development of bio-safety regulatory structures dialogue between the policymakers and scientists. However, according to the evaluation of 2012, it did not achieve the planned new product/process outcomes and economic impacts because of the framing and hence design in the 'linear view' of research to use.

5.2.4 Innovation policy support program: Policy Support Programs of Multilateral Agencies

This case study examined innovation policy reviews and reports on innovation issues by the World Bank, OECD, UNCTAD, UNIDO, UNESCO, ADB and IDRC that aim to strengthening innovation systems and systems capacity. Innovation has many interpretations, and innovation systems are difficult concepts for many outside the field to understand. While there is little doubt that these high level STI/NIS reviews have influenced national policies, there is little available information providing a thorough assessment of the extent to which:

- The country found the analysis comprehensive and useful
- The extent to which the recommendations were implemented
- Why implementation was successful/limited
- What learning by actors in the country gained from the experience of implementation and post-implementation review
- Whether that learning about implementation issues also contributed to the frameworks for analysis by the international agencies.

5.2.5 Multi-level innovation support program: the Inter-America Development Bank

With an annual operating budget of about USD570 million and a capacity to provide an average of $12 billion in lending per year, the Inter-America Development Bank (IDB) provides development funding to the countries of Latin America and the Caribbean. The IDB's Competitiveness, Technology and Innovation Division provides technical assistance and loan finance for innovation-related projects in all sectors, but with an emphasis on corporate innovation, STI infrastructure and innovation ecosystems. IDB's projects are developed in response to requests from a country and within the framework of the country-focused programming.

IDB's innovation-related programs are diverse and include training in STI for advanced human capital; strengthening scientific and technological infrastructure; designing public policies to promote innovation; and strengthening institutional capacity of the agencies and ministries that are responsible for implementing these policies.

The evaluation and learning outcomes for the diverse programs of the IBD (detailed in Volume 2, Appendix 1) point to several key challenges for this type of innovation support programs, ranging from the need for better coordination among key public and private actors, policy capability development and the implications for effective management of programs and appropriate selection criteria under the significant complexity due to a strategic focus on inclusion and sustainability, among others.

5.3 Vietnam's history and experience with innovation support programs

This study began with a landscape review of most international innovation support programs and projects for the last 20 years. Vietnam is a lower middle-income economy and strives to reach higher middle-income status in 2030 and a high-income level of development by 2045. Foreign donors and other international organisations have always been supportive of Vietnam's development and assisting in the creation and operation of innovation programs is among key measures.

Nordic partners such as Sweden and Finland are among the most active and their programs are having long-term impact. Apart from that, several other OECD economies such as Germany, UK, Canada, Korea, Japan, Belgium, Australia and the US supported Vietnam in innovation programs. International organisations like OECD, the World Bank and the Asian Development Bank (ADB) also played an important role in executing several key projects and programs on innovation.

The landscape scanning and the four in-depth case studies show a great variety in terms of nature and diversity. Innovation support programs in Vietnam can be divided into multi-phases or one-off, with focus on action-oriented or policy advice/institutional analysis or knowledge sharing and training. Some programs were specifically to serve as direct inputs for the new science and technology (S&T) strategy cycles in Vietnam. Other programs did not have direct input to the strategy drafting of various cycles, but still contributed to different aspects of policy and strategy and law-making actions such as the drafting of the first Ordinance of Technology Transfer of Vietnam, the Law on Technology Transfer and the Science and Technology Law.

Some projects were to review the national innovation system (NIS) and related policy for innovation for further actions. Other programs went further to propose direct and specific funding support to develop the whole NIS or some of its components such as start-ups. There were also projects just for sharing knowledge and experiences of other countries on developing the NIS. One way or another, all these programs and projects contributed significantly to introducing, nurturing and developing innovation and innovation systems in Vietnam.

What the Vietnam study highlights is the importance of a historical perspective on how programs have changed over time in response to the change in environments in recipient countries.

The four in-depth case studies include:

5.3.1 Multi-level/portfolio-oriented program: SAREC Research Cooperation Program

The support from SAREC for Vietnam lasted for several decades with four phases of support, one way or another related to innovation activities. All activities completed in 2008 with many publications and training and education outputs. The program is an example of a m*ulti- level/portfolio-oriented program* with strong focus on policy research and advocacy. At the same time, given some sub-programs and projects, it could be called a m*ission-oriented program* that worked on very specific target areas like agriculture, healthcare, environment or biotechnology.

Overall, the cooperation program of SAREC/Sida with Vietnam had several positive dimensions. The projects demonstrated impact in different ways depending on type of project, e.g., on the improvement of production, others on improved health, and in the STI studies, projects improved overall STI, legal, institutional systems and built capacity.

A few shortcomings were noted, including an observation that this cooperation program has not been close enough linked to Vietnamese own research agenda and programs. There was also lack of follow up and dissemination of research findings. Cooperation initiatives tend to depend on lead persons and ad-hoc circumstances, not becoming common practice yet for everyone.

5.3.2 Innovation process-oriented program: Innovation Partnership Program (IPP)

In February 2008, on the ocassion of a visit by Finland's President to Vietnam, MOST (Ministry of Science and Technology) and the Ministry of Economics and Employment of Finland signed an MOU to support cooperation in S&T, aiming at creating a cooperation program, with suitable financial mechanism. The IPP program ran over two distinct phases over almost 10 years.

The program brought a strong impetus for innovation development in Vietnam, with diversified focus and components of activities. Phase 1 introduced innovation studies and the platform for innovation implementation and is an *innovation process-oriented program*. Still, a central theme of the program was on *entrepreneurship with start-up ecosystems* as a focus of most of activities, although the policy angle and policy experiment were also an important component of both phases. The shifting of attention from overall innovation scenery in phase 1 to start-up ecosystem in phase 2 reflected an evolution in innovation thinking and practices in Vietnam. The impact of this program was quite substantial, with both tangible results and outputs and intangible and unexpected outcomes (see Volume 2, Appendix 2 for details).

5.3.3 Policy-oriented innovation support program: IDRC S&T Policy Review and OECD-WB STI Policy Review

The third case study is a comparison of policy reviews of Vietnam's NIS. Both projects aimed to provide policy analyses frameworks, tools and findings to advise and support different levels of policy makers in Vietnam. Different main Vietnamese partners were involved beside the same main partner MOST, but the reviews applied the same methodology to their reviews, including visits by international teams. In terms of output, both projects produced very good policy analytical reports and published them in English, and both did not come up with a Vietnamese version of their publication.

Both projects can be considered as successful *policy-oriented* activities with very good analytical findings that contributed actively into the process of policy making and reform of the STI system. One of the success factors was the right choice of partners, both international and national. However, due to the lack of Vietnamese versions being published, the impact of the projects has been limited to a smaller circle of professionals and researchers and some policy makers, and projects should pay sufficient attention and efforts on dissemination activities among Vietnamese users.

5.3.4 Policy-oriented innovation support program: Policy advice to the S&T Strategy 2011–2020 plus the High-Tech Law Implementation

The project was initiated by the National Institute for Science and Technology Policy and Strategic Studies (NISTPASS) and supported by United Nations Industrial Development Organisation (UNIDO) for policy advice to Vietnam's S&T Strategy. Additionally, a small component was for supporting the implementation process of a newly enacted High-Tech Law. The purpose of the project was to enhance the capacity of Vietnamese stakeholders in developing policies and strategies on science, technology and industrial innovation compatible with the economic and social goals of the country. The project duration was 2 years (2009–2011) with funding from One UN Fund (Spanish contribution) of USD 600,000, of which 76% was for international experts' cost. The Government of Vietnam contributed in-kind for staff costing and some local expenses.

However, the project failed to achieve its goals in full. Several standard methodologies for policy and strategy making in many countries (e.g., SWOT analysis, Technology Foresight, Delphi survey etc.), did not work well in the Vietnamese context. There was great difficulty in gathering sufficient

numbers of experts, and translation of foresighting information into useable material for the S&T team was another difficulty. This led to the conclusion that indigenous capacity building as an explicit effort must be a top priority for this kind of project.

Additionally, such a *policy-oriented project* should be considered as transferring and learning tacit knowledge of policy making as the top priority. Unlike other ordinary technology programs that deal with transfer of tangible knowledge and skill in a conventional way (such as bridge construction or road technology), tacit knowledge and policy learning require different approaches and preparation.

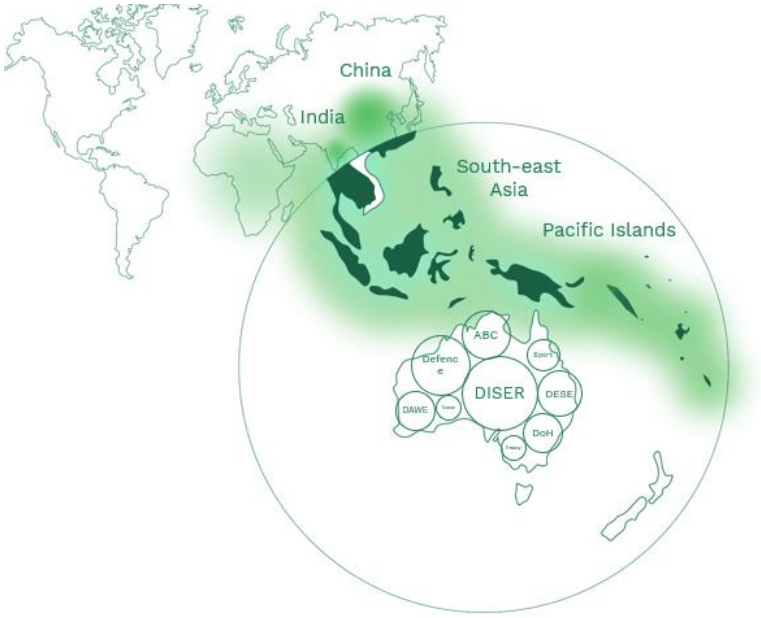
The readiness of Vietnamese structures and context (absorptive capacity, structure of interactive linkages, interagency relations) for a technological methodology such as a Foresight platform is another important point to consider. The way of doing strategy in Vietnam was quite different and this posed a potential of non-receptive attitude of stakeholders in policy making process.

Despite many problems and issues, there were some contributions of the project to overall understanding of Vietnamese community of scholars on Foresight exercises and a small part of the capacity building efforts was achieved via workshops and seminars where knowledge was shared and transferred. Some novel elements were incorporated into the draft of new STI strategy.

5.4 Australian international innovation support programs (focussed on innovation support outside of traditional ODA)

The study of Australian innovation support programs covers a range of Australian government agencies and departments innovation programs in emerging economies over the last ten years, outside of traditional ODA (covered in the international study). In Australia, most international innovation support programs undertaken by the Australian Government focus their efforts and funding towards programs in South-East Asia and the Pacific (see Figure 5.1, below).

Figure 5.1 Country focus of Australian Government innovation support programs



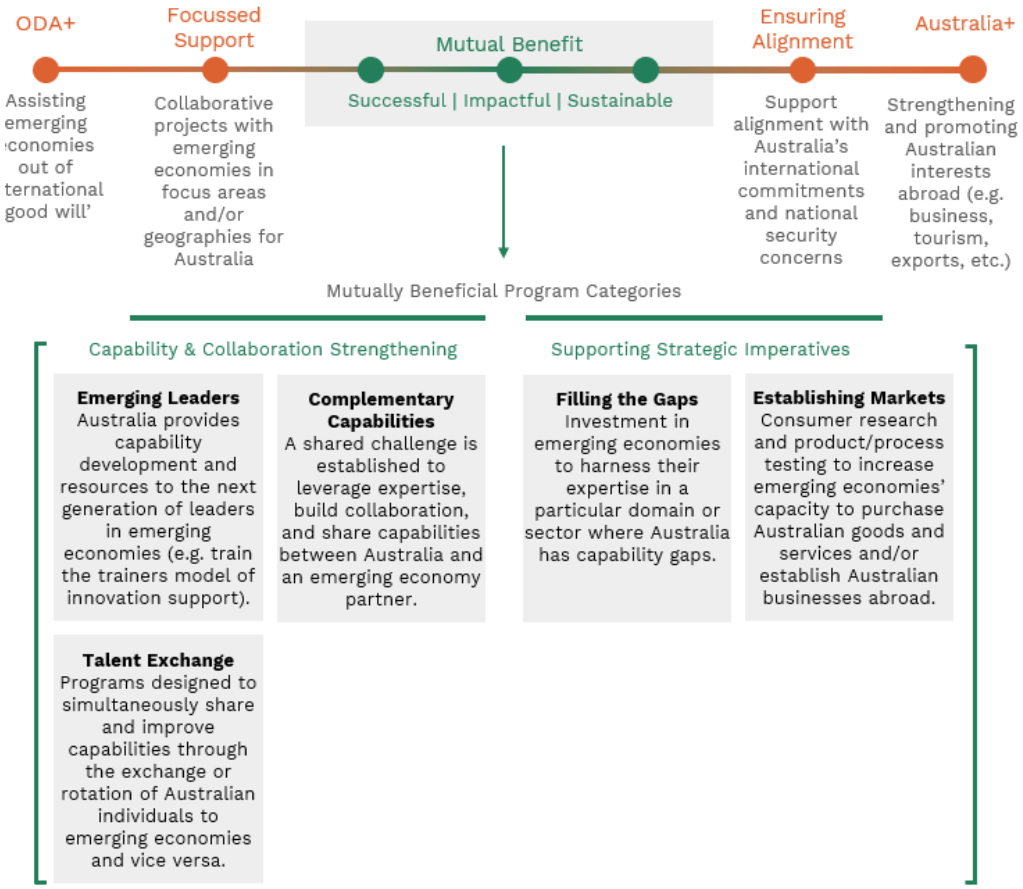
The Department of Industry, Science, Energy and Resources (DISER), Department of Defense and the Australian Broadcasting Corporation (ABC) led examples are the most non-ODA type programs assessed in the study, and the typical types and structure of the programs can be summarized as below:

- Most programs within scope had funding of AUD10 million–80 million
- While most of the programs have a 4–6-year timeframe, this varied largely depending on the program's intent, with some innovation funding programs lasting only 6 months and some long-term programs running for 15+ years.
- Most programs funded joint research between Australian and international universities
- While the scope of this inquiry excluded ODA programs, DFAT is still one of the largest funders for programs originated by other Australian Government Departments and Agencies.

The study gathered insights into why programs are designed, implemented and what enables or hinders their success. The innovation program landscape ranges from projects and programs focused solely on outcomes in emerging economies (called ODA+) to those focused only on promoting Australia abroad (called Australia+) (see Figure 5.2).

The Australian Government's intent for funding and support low- and lower-middle income countries emphasises a need for mutual benefit between Australia and the partner. From this starting point, the Australian Government utilises a range of program design and implementation patterns. Five mutually beneficial program design and implementation categories were identified through the study (see Figure 5.2).

Figure 5.2 Program design and implementation categories



While most of the contributing factors of successful and unsuccessful innovation support programs are shared with other categories of international programs, there are key points of difference or 'peculiarities' between the two. The key driver of these differences, however, is quite simple. In general, more 'traditional' international programs must deliver tangible outcomes and impact from

their activities for the beneficiaries which they have targeted. Innovation support programs might indirectly achieve the same outcomes and impact, but their primary goal is around creating a foundation, or environment, for innovation to occur both during the program and in the future.

This means the process by which they select partners, invest, plan activities and monitor performance must be recalibrated to this reality. Innovation support programs fail to reach their potential when a linear approach (inputs-outputs-outcomes-impact) to program design and implementation is applied in this context. These insights were drawn from the following 4 case studies (detailed in Volume 2 of this report):

5.4.1 Mission-oriented program: Indonesia-Australia Red Meat & Cattle Partnership

The Indonesia-Australia Partnership on food security in the Red Meat & Cattle sector is a AUD60 million fund administered over 10 years (2013–2024) that is coordinated by the Department of Agriculture, Water and the Environment and supported through implementation partner Coffey International Development in Indonesia. The program's goals are to increase the capacity of the Indonesian red meat and cattle sectors and create a more robust market and investment environment in both countries. The midterm evaluation and stakeholder engagement conducted as part of this project pointed to significant challenges related to delivering innovation support, maintain stakeholder buy-in, and ensuring the program's achievements are effectively communicated back to Australia.

5.4.2 Innovation process-oriented program: Pacific Media Assistance Scheme

The Pacific Media Assistance Scheme (PACMAS) is a communications program that supports the development of a diverse, independent and professional Pacific media sector. PACMAS aims to facilitate discourse across government, business and civil society in the Pacific while developing the capabilities and infrastructure for the delivery of different broadcasting mediums. This program assists Pacific Media practitioners to consistently report responsibly, mediate discussions about key issues impacting development, and provide a platform to create long-lasting behaviour and social change.

5.4.3 Innovation process-oriented program: Team Up

Team Up is a sports-for-development program in the Pacific, which also serves to strengthen Australia's overarching goal of enhancing engagement with the Pacific Islands. Team Up is focused on supporting all people to realise their full potential through sport by providing sport-based activities that address common challenges. The program spans 10 years (2015–2025), with AUD6 million to be directed by Sport Australia and DFAT and implemented by a network of partners across the Pacific. Team Up has outlined sustainable impact of the program as a high priority. Policy and governance assistance, training the trainers, high levels of community engagement and expanding the network of in-country partners who run the projects have all been a priority in the programs design and implementation to this point.

5.4.4 Platform technologies-oriented program: Australia-India Strategic Research Fund

The Australia-India Strategic Research Fund (AISRF) was initiated in 2006 as a bilateral science collaboration between the Australian and Indian governments. Managed within Australia by DISER, the Australian government has dispersed more than $85 million in grant funding over the life of the program. The goals of the program are to increase collaboration between Australian and Indian researchers in 'leading-edge' research and technology, strengthen the strategic alliance and facilitate both countries' access to global science and technology systems. While the focus of this program and model of engagement are centred on research collaboration rather than directly

supporting innovation in emerging countries, the AISRF helps to validate the importance of ongoing collaboration around areas of shared mutual benefit and the risks associated with only a small subset of stakeholders involved in those collaborations.

The Australian study shows that there are a great number of programs and initiatives supporting innovation as part of Australia's more general international engagement. There is a great deal of diversity along a spectrum where some programs are structured around the more traditional science collaboration aligned to Australia's objectives, while at the other end of the spectrum programs are more aligned to assisting partner countries objectives and are part of Australia's diplomatic and regional co-development agenda.

5.5 CSIRO involvement in international projects supporting innovation

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) has an impact mandate and associated strong focus on research translation to stimulate innovation and scale impact. However, CSIRO understands innovation as a mostly technological phenomenon driven by R&D, where the organisation and its partners develop new and rework existing stocks of knowledge in the pursuit of specific impact goals. As the five CSIRO case studies show, there is a recognition of other forms of innovation (organisational, institutional, social), but outside the sphere of formal R&D activity, these are not generally recognised as innovations in their own right, even though the organisation frames its R&D activities within larger systemic social, economic and environmental goals.

Internationally, CSIRO supports the Australian Government's strategic objectives and responsibilities. CSIRO is a key partner of Australia's international aid and development activities for the Indo-Pacific region, and CSIRO has established sometimes decades long partnerships with local government, industry, research and other groups. These engagements further support CSIRO's own impact goals and strategic objectives where issues such as climate change, sustainability, food safety and security etc. constitute common and shared concerns.

Since 2015, CSIRO has been in involved in more than 300 international collaboration projects and activities with overseas partners, either directly, or under Australian government programs[4]. CSIRO's international activities represent clearly defined STI for development aims that address specific capability and capacity gaps. These activities cover a range of science & technology related innovation supports that are not mutually exclusive, but constitute types of engagements that have distinct purposes, including education & training, research collaborations to address partner specific problems or opportunities and the provision of research and technology infrastructure and collections.

Most activities where CSIRO partners directly with international partners are 1–3 years in duration, although some build onto one another into sometimes decades long collaborations. The projects/activities funded by the Australian government vary from 1–5 years, and it is not possible to assess from the available data to what extent they represent ongoing, evolving collaborations.

The five projects examined more deeply as case studies all involve research to support the capacity to address areas of common concern (challenge spaces or impact). This is saying that the projects had an impact focus at the outset, and their difference is in their modalities for achieving them. The projects represent diversity in their nature and focus, ranging from almost single focus

[4] Analysis is based on CSIRO data as per its internal O2D system (implemented in 2015) and is not publicly available. Accessed August 2021.

(entrepreneurial competencies, or STI capacity for commercial products and services) to multi focus (mix of STI and institutional innovation supports):

5.5.1 Platform technology-oriented program: Earth Observation for Climate Smart Innovation

This initiative promotes the use of earth observation data through building an open data cube to benefit the regional down-stream analytics and geospatial industry develop multiple applications and services. A feature is the internationalization of innovation based on a common platform technology that is customized to country needs and supported by international partnerships.

This initiative is centred around platform technologies or infrastructure to build the capacity of countries to address specific challenges, in this case climate change. The innovation focus is on STI capacity with technical skills transfer and developing the architecture of partnerships required to develop new products and services.

5.5.2 Entrepreneurial development within a mission-oriented program: Indonesia-Australia Plastics Innovation Hub

The Hub is an initiative to stand up a deep tech entrepreneurial ecosystem around the challenge of plastic waste. The Hub's activities are focussed on building entrepreneurial competencies to accelerate deep technology commercialisation and thus address the existing gap between work being produced in Indonesia and its translation to achieve outcomes in identified priority areas. This initiative has tangible shorter term outcome ambitions and limited support for policy or social capacity building.

5.5.3 Innovation process-oriented program: Knowledge brokering for Pacific climate futures

This project is co-designing approaches with NGOs and Pacific Islander communities to better translate climate risks into decision-making and policy. Its activities focus on developing local participatory learning processes and mechanisms for integrating climate and climate related data and knowledge outputs into decision making and pathways suited to stakeholder's particular contexts and convening the necessary partnerships and networks. The orientation here is innovation processes, supporting the capacity of innovations systems as a foundation for broader social and economic growth. Institutional development and capacity building is approached flexibly, from the bottom-up, involving networks of informal leaders.

5.5.4 Platform technology-oriented program: SIMA Austral

This project built and deployed a platform technology to assist an industry to address specific issues; in this case the theme is sustainable aquaculture – building the economic competitiveness of the Chilean salmon industry while addressing environmental challenges. A program of training underpinned the absorptive capacity of the partner agency in the use of the platform and to build sanitary diagnostics and biosecurity skills. This project was an attempt to introduce a new technology platform as a tool for creating policy and strategy change, with some technical skills transfer and capacity building.

5.5.5 Multi-level oriented program: IORA Blue Carbon Hub

This initiative centres around a partnership infrastructure or platform, a 'regional knowledge sharing hub' around the theme of blue carbon that aims to support a broader innovation agenda. Its activities support locally driven R&D knowledge creation and capacity building, while aiming to drive the evolution of policy and financing frameworks. The Hub represents a form of international, interagency innovation alliance that brings together external experts and local partners that act towards co-designing and co-implementing activities from start to end, providing the foundation for

activities to be more directly and closely geared to domestic development planning. The initiative integrates different forms of innovation support at different scales and levels (STI capacity, institutional and policy development, partnership development).

This study provides increasing evidence the traditional technology-first approach to innovation is no longer sufficient for innovation systems strengthening, even within the context of projects undertaken by a national R&D organisation.

6 Overarching analysis of innovation support programs

This sections draws together some board features and analysis of innovation programs discussed in the earlier sections

6.1 Framing the discussion

Explanation to prescription: The innovation system approach was initially developed as an analytical tool for explaining innovation performance in developed economies where innovation systems had evolved over many decades – with no overall system building design. Beyond emphasising the importance of effective interaction and policy coherence, it was neither a normative theory nor a theory of innovation system genesis. As is also the case with industry cluster approaches, and entrepreneurial ecosystems based on the Silicon Valley model, what were explanatory models became the basis for normative system-design models. Initially, these prescriptive models were simply based on what were seen to be the essential characteristics of the high-performing exemplar innovation system/cluster/entrepreneurial ecosystem. One consequence of the influence of these exemplars is that in many countries, a high emphasis has been placed on the role of formal R&D, and this has contributed to the enduring influence of science and technology push approaches. More recently a body of knowledge has begun to accumulate around the processes of innovation system/cluster/entrepreneurial ecosystem genesis and evolution. As a result, the conceptual foundations for prescriptive approaches to innovation system building are growing, but remains limited, particularly in emerging economy contexts.

Emerging Economy Context: The majority of the literature on, and hence understanding of, innovation systems concerns studies and experience in OECD economies. The context of emerging economies is different in many respects, among which one of the most important is the large role of the informal sector.

Impediments to assessment: There are two major impediments to assessing the effectiveness of ODA interventions in contributing to strengthening innovation systems in emerging economies: the evidence base is very limited, in part due to the lack of long-term evaluations, and there is a high level of diversity in the objectives and mode of interventions, and in the contexts in which the projects have been developed.

Systems frameworks: There are several related innovation systems frameworks, including sectoral and regional innovation systems and innovation ecosystems. While these share many foundational concepts, the frameworks for entrepreneurial ecosystems are built on different conceptual building blocks. It would be a mistake to not differentiate these two different types of system/ecosystem strengthening endeavours and to seek to draw lessons from an undifferentiated assessment of the experience of innovation and entrepreneurship projects. Entrepreneurial ecosystems have a vital role in bringing new actors into innovation systems – a role that will be particularly important in the decades of disruption that lie ahead, but entrepreneurial ecosystems are not innovation systems.

Beyond S&T: One strong message of the innovation systems approach is the key role of institutions, both formal policies and laws and the less formal cultures of organisations and societies. These shape perceptions and incentives, including the formation and behaviour of markets. They also embody the power relations in a society. The history of innovation system development is a story of the co-evolution of technologies, institutions and organisations, and hence the interdependence of technological, organisational and institutional innovation. This perspective is largely absent in the discussion of innovation system strengthening in in emerging economies.

6.2 Donor practice: general features and meta evaluation lesson

Several international bilateral agencies have been prominent in using the innovation systems framing to help partner countries in the Global South tackle both policy and operational dimensions of innovation capacity development. Canadian IDRC and the Scandinavian countries have been particularly prominent often establishing decades long programming partnerships.

The complexity of an innovation capacity agenda has meant that different bilateral agencies have approached the task in a number distinctly different ways (see Table 4.1) often tackling clusters of innovation systems failures (as described in Appendix 1). Approaches have often evolved through a sequence of phases over many years.

Often, STI policy is used as an entry point to help partner countries plan strategically for the development of innovation capacity. Frequently, this takes the form of policy analysis and evaluation, foresighting or diagnostic studies of national or sectoral innovation systems. In some cases, this is focused on the specific innovation challenges associated with new platform technologies such as biotechnology. Policy strengthening programs are often a precursor to programs focused on more directly supporting innovation. For example, these may have a thematic focus on a particular geography or a particular challenge (e.g., dealing with agro-industrial waste, sustainable water resource management or marine plastics). The focus could be on building technical capability in a particular sector (e.g., digital capability for e-commerce or export competitiveness). Another alternative is that the thematic focus is on supporting particular modes of innovation such as start-up company development, inclusive innovation or social innovation or building university-industry linkages.

An important feature of these programs, which distinguishes them from more general development programming, is that they are organised and conceived as explicit innovation policy experiments. That is to say, the focus is on driving innovation in practice in firms and communities, but explicitly exploring the policy and institutional barriers to enabling and scaling innovation and testing ways of tackling these barriers. This, by necessity, requires strong engagement and dialogue with policy agencies, but also with a broad set of stakeholders associated with the particular innovation 'field' being explored.

Thematic innovation hubs are found as another manifestation of this sort of approach. Here the approach is to focus on mobilising different knowledge sources and interests round a geographically or challenge bounded theme – the idea being that the incubation of solutions will not only build relationships and resources that support innovation but will also have a sufficient demonstration effect to encourage the crowding in of market, civil society and policy support.

As is seen in the previous sections, there is significant heterogeneity in donor practice. There have recently been several attempts to look across the breadth of donor experience. Some of the issues raised in recent reports include:

Innovation push: Building a grassroots demand that provides a clear signal for innovation development is often slow and the signals ambiguous. A recent OECD review concluded that:

> *" What is common across many of the strategic innovation approaches reviewed as part of the DAC [Development Assistance Committee) peer learning exercise on innovation for development*

is that many are based on an implicit assumption of 'innovation push' to developing countries, as opposed to 'innovation facilitation' with and for actors in developing countries."[5]

Experiment not prescription: While the systemic approach to innovation can lead to greater understanding, the application of those concepts does not lead to prescriptions for policy and is highly context-specific. Consequently, an experimental and learning approach to innovation capability development is essential[6].

Measuring intangibles: As learning (of many types) and building social capital are key processes of innovation capability development, assessing progress in these dimensions is a critical aspect of evaluation[7].

Developing appropriate staff: Innovation support requires what are often new skills and attitudes in local and expatriate staff, but, according to a recent OECD review: "*Innovation has not yet convinced the majority of staff in any DAC member of its value. In some organisations, certain senior managers and frontline staff may support innovation, but there is a 'frozen middle.'*"[8]

6.3 Innovation support program modalities: choices have consequences

Section 4 describes the key features of six types of innovation support program found in ODA programming. Table 4.2 lists case study projects that were subject to in depth review by this study and which were used to explore lessons from these different types of program.

As discussed previously, the reality is that there has often been an evolution and sequencing of program types over many years. In the more mature ODA donors this is often a progression from a policy focus to an innovation action orientation, but structured as part of a larger policy learning process. A more recent trend has been to focus on more entrepreneurial focused programming with an 'ecosystem' framing or tightly defined mission orientation. This reflects the desire of donors to fund more bounded activities with tangible outcomes and impact achievable during the lifetime of the program. In part this is a response to extended time frames and unpredictable impact logics and pathways of more systemically focused innovation support approaches such as the policy-oriented or multi-dimensional/portfolio approaches. Yet, just as the more systemic approaches have trade-offs, there are also consequences of choosing more bounded approaches. The following discusses the consequences and trade-offs associated with different program designs.

6.3.1 Entrepreneurial-oriented programs

Bounded with tangible and 'measurable' outcome ambitions, this type of program is well suited to short term funding. Business creation is a critical part of innovation capacity and general economic development including employment creation. However, business led growth is unlikely to drive innovation that supports inclusion and sustainability ambitions without explicit policy and regulatory support. Entrepreneurial ecosystem framing gives little attention to institutional issues in the wider innovation system that prevent the diffusion of business led innovations. This weakens the ability of the approach to catalyse more systemic forms of innovation capacity. The approach is poorly

[5] OECD, 2020. The Development Dimension. Innovation for Development Impact. Lessons from the OECD Development Assistance Committee. Paris: OECD. Pp 27-8.
[6] Rath et al, 2012a, p122
[7] Rath et al, 2012a, p123
[8] OECD, 2020. The Development Dimension. Innovation for Development Impact. Lessons from the OECD Development Assistance Committee. Paris: OECD. p.31

adapted to dealing with socio-technical innovation of the sort needed to address systemic challenges associated with environmental sustainability and social inclusion.

6.3.2 Innovation process-oriented programs

The explicit systemic framing of these approaches recognises that while innovation action is always going to be centred on businesses and communities, this needs to be supported by a wider enabling environment, a set of innovation-oriented capabilities and the development of long-term relationships between partners. Such programs often adopt a 'cherry picked' focus on a specific set of innovation relationships, such as university-industry partnerships. Alternatively, these programs attempt to support general networks across the innovation system, with the result that they spread themselves to thinly and fail to gain traction and support to sustain efforts when project support is withdrawn. The focus on research industry partnerships rarely reflects the 'national style of innovation' in the emerging economies where a large informal sector is present and the approach of reworking the existing stock of knowledge from both local and global sources is the dominant mode of innovation. Generic capacity outcomes across multiple sectors are difficult to track in the short term and often two or three program cycles are needed to see impacts.

6.3.3 Policy-oriented programs

Policy-oriented program have been particularly powerful at key policy inflection points, for example, the reorientation from science and technology policy to science, technology **and innovation** policy, or the need to reorientate innovation to deal with new platform technologies, such as biotechnology or industry 4.0. Diagnostics studies from policy-oriented programs can be an important boundary object in negotiating donor-host programming priorities and approaches. However, policy programs can suffer from normative and blueprint approaches to introducing new innovation policy frameworks developed in the Global North, rather than a more contextualised approach to innovation policy development. In addition, policy support is only as good as policy implementation. This means that outcomes and impacts from policy-oriented programs are highly uncertain and unpredictable. Changing mindsets and creating a 'new STI conversation' is seen as a key result by stakeholders in the partner countries. Its noted that policy-oriented programs fail when insufficient attention is given to local policy analysis and formulation capability and where inappropriate international expertise is brought in. Capacity development is particularly important for developing a tradition of policy learning and continuous improvement and at key inflection points where revisioning of the innovation agenda is needed, for example, the transformational innovation agenda associated with the SDG's.

6.3.4 Multi-level/portfolio-oriented programs

This is the most comprehensive support approach and the one which most closely attempts to use a whole of innovation system approach, with a practice to policy scope of capacity building and a very strong learning orientation. Like the innovation process-oriented approach, it runs the risk of spreading resources too thinly resulting in program fragmentation with many small-scale activities failing to trigger wider systemic changes. It also poses challenges for M&E because of the intangibility of outcomes and the unpredictability and long-term nature of impact pathways. As a result it requires long-term donor commitment. This needs to be accompanied by intensive and highly capable management to co-ordinate the different program elements and relationships, while keeping the strategic intent of the program in focus, recognising that this might its self-evolve during implementation due to changing contexts or 'discovered' realities and shifting policy priorities of the host country. The selection of a thematic focus that is also policy priority is an important way of focusing efforts and creating tangible outcomes that have a demonstration effect in policy learning.

6.3.5 Deploying new platform technology-oriented programs

Developing technological capability across firms, R&D organisation and relevant policy domains is a key element of economic development strategies. However, this is a large scale and long, often decades long, capacity development task. Policy support has been a valuable entry point, but most useful when followed up with more innovation action-oriented programs. Like other approaches a clear thematic focus with strong policy visibility is a useful way of concentrating support resources and delivering tangible results within program cycles.

6.3.6 Mission-oriented programs

Mission-oriented approaches embody much of current thinking on focusing innovation on societal scale development aspiration that are complex in nature and require social and technical innovation. The more successful programs have been those that are designed as a policy-facing dialogue platforms that commissions scoping studies and set up experiments to test solutions and learn from them. Thematic hubs sometimes overly focus on technology acceleration and commercialisation through an entrepreneurial ecosystem lens. This tends to overlook the role of social innovation in addressing societal grand challenges and pays less attention to policy engagement and the need for institutional and policy reform needed to enact and scale socio-technical change.

7 The forward innovation support agenda

Emerging economies face three concurrent dimensions of challenge for innovation policy and for innovation systems strengthening**.** As summarised in Figure 7.1, these dimensions are those of:

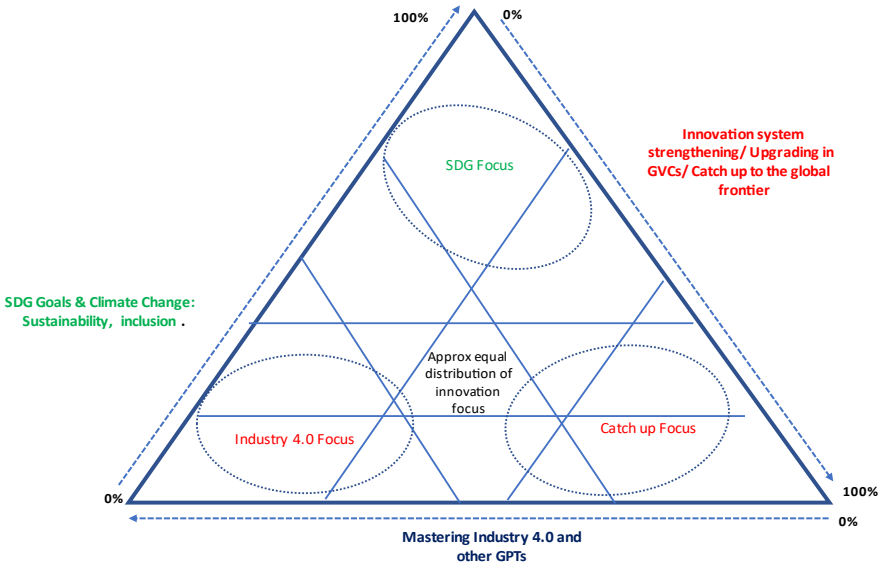
1. Innovation system strengthening and upgrading: Mastery of current technologies to raise performance in domestic industries and improve domestic value-adding and employment, build infrastructure to enable growth and upgrade in global value chains
2. Mastering industry 4.0: Begin mastering of new digital technologies (Industry 4.0) and biotechnology, particularly to effectively apply these technologies in all sectors and to build a high level of innovation competence in niches of national relevance, and
3. Addressing the SDG, social inclusion and sustainability: Effectively addressing growing challenges of climate change and of inequality across regions and social groups.

The particular form of these challenges and the current scope for addressing them varies widely among countries. However, no country can afford to not address all three challenges. Key questions for each country are:

- The balance of focus on these three dimensions of challenge
- What policies and capabilities will be required for effective responses to each challenge
- The scope for approaches that integrate responses to the challenges.

There is an increasing tendency to create a false dichotomy between the different approaches needed to address these concerns. For example, the shift to transformational innovation needed to address the SDGs is often pitched as an alternative to innovation actors and processes that have been important in the past and will remain so. Key message from recent STI policy studies is the need for a **layering of STI policies and approaches**. This recognises that development challenges are going to need a repertoire of different innovation approaches that include R&D technology led innovation, start-up led innovation as well as social innovation, and that innovation directions will need to be led by both the market and public policy for societal benefit. The question for emerging economies is what mix of STI policies and approaches (both old and new) will be needed to in a particular country setting and at a particular point in time.

Figure 7.1 Addressing Three Unavoidable Challenges Concurrently



7.1 Principles for Strengthening Innovation Systems

Considering the insights from the review of international experience of initiatives to strengthen innovation (and entrepreneurial) systems, and the innovation-related challenges that emerging economies are likely to face over the next 20 years, a set of eight inter-related principles for innovation system strengthening and transformation are outlined below:

Planning to Learn: Innovation projects must be designed and developed in a context of complexity, uncertainty and multiple market, systems and transformational failures. Detailed *a priori* planning must give way to an active learning approach A learning plan considers learning by all stakeholders is a key objective of all innovation support initiatives – learning about opportunities and risks, the interests and capabilities for other stakeholders, the areas of shared interest, etc. A 'learning plan' approach would support increases in investment as uncertainty decreases.

An Evolving Theory of Change: A ToC makes explicit the assumptions that shape the initial approach and the decisions regarding scope, participants, objectives etc. Developed collaboratively, it forms the initial basis of shared views of the situation, the challenges and the approach to change. While the ToC reflects the initial diagnosis and assessment (e.g., of the role of incentives, risks and constraints on change) it evolves as assumptions are tested and perceptions change. It helps to and identify the stresses and conflicts (between groups, areas of policy and objectives) that arise. The process of developing and reviewing the ToC is a key aspect of learning.

Adaptive Management: A planning approach and the use of an evolving ToC means that detailed pre-project planning is not appropriate. An adaptive management approach is needed. This has challenging implications for staffing, budgeting and accountability as project managers must respond to effectively to contingencies and emerging opportunities.

Policy Experiments: In the context of innovation and innovation policy, change involves experimentation. Managed experiment, robust evaluation and openness to learning builds knowledge, capability and confidence.

Organisational and Institutional Innovation: Technologies, organisations and institutions (in the sense of rules, conventions, policies, cultural norms) co-evolve. The lack of organisational and institutional innovation is often what blocks or reduces the returns to or incentive for technological

change. Untethering perceptions of innovation from a fixation with technology can be a step toward empowering organisational and institutional innovation- which is, after all, the essence of innovation system growth and performance. More broadly, and including at the level of national innovation system, emphasising the extent to which all organisational and policy models are contingent can encourage more open thinking about the scope for innovation for each context.

Endogenous Drivers: Innovation system formation, growth and change is an endogenous process. The primary objective of an intervention to support innovation systems strengthening is to develop the agency of the participants, particularly those with the least agency, and to grow the level of endogenous change momentum and capability. Project managers can assist in identifying opportunities, barriers, risks and incentives for all participants. But it is participants' perceptions of those issues that will frame how problems and opportunities are assessed and addressed.

Entrepreneurship: Entrepreneurship in all its forms – leading the formation of new for-profit or social enterprises and the formation or transformation of organisations and policies – is a form of (business, social, organisational, institutional) experiment and a critical driver of change. Support for entrepreneurs is one important dimension for supporting innovation system strengthening and transformation.

Sustained Engagement: Another implication of this approach to innovation support is that the key processes of capability building, alignment of interests, trust building, discovery of opportunity etc are likely to require sustained support over perhaps long time periods. For innovation systems building, innovation provides a focusing device for learning and relationship building, and not an end in itself. It is very likely that an effective approach to innovation system strengthening will require a range of complementary interventions, for example, training, facilitation, co-funding.

Transformation of innovation systems: The development of innovation systems in OECD economies has included periods of transformational change, rather than a steady process of growth along a trajectory of accumulation.[9] Those periods of transformational change have involved substantial economic and social disruption, with skewed distributions of costs and benefits. What is new is that the perspective through which analysts, and to some extent governments, frame policies for transformational change is now an innovation systems perspective. Hence, the directionality of innovation system evolution is seen as an explicit policy issue, rather than the 'natural' outcome of market forces.[10] The SDGs, for example, aim to set a normative direction for policy, including innovation policy. Innovation system strengthening strategies that combine mission--oriented innovation policies might also provide an approach to directionality. While such interventions would be likely to provide a range of temporary incentives for participant engagement, the processes of collaboration and capability development could lead to enduring innovation system change.[11]

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[9] See, for example: Baumol, W.J., 2014. The free-market innovation machine. Princeton University Press; Klepper, S., 2015. Experimental capitalism. Princeton University Press; McCraw, T.K., 1998.Creating modern capitalism: how entrepreneurs, companies, and countries triumphed in three industrial revolutions. Harvard University Press; Louçã, F., 2020. Chris Freeman forging the evolution of evolutionary economics. Industrial and Corporate Change, 29(4), pp.1037- 1046; Clark, J., Freeman, C. and Soete, L., 1981. Long waves, inventions, and innovations. Futures, 13(4), pp.308-322

[10] For example: Schot, J., Daniels, C., Torrens, J. and Bloomfield, G., 2017. Developing a shared understanding of transformative innovation policy. TIPC Research Brief, 1.

[11] Hekkert, M.P., Janssen, M.J., Wesseling, J.H. and Negro, S.O., 2020. Mission-oriented innovation systems. Environmental Innovation and Societal Transitions, 34, pp.76-79; Janssen, M.J., Torrens, J., Wesseling, J.H. and Wanzenböck, I., 2021. The promises and premises of mission-oriented innovation policy—A reflection and ways forward. Science and Public Policy, 48(3), pp.438-444.

8 Principles for program design

It needs to be stressed that general ODA good practice principles apply to the design and implementation of innovation support programs (genuine partnerships, consultation, flexibility, etc.). However, these programs also possess unique features that require approaches above and beyond ODA good practice. Ten principles for designing innovation support programs are outlined below:

It is important to correctly frame the task of innovation support as a systemic challenge and be clear on the implementation and impact logic that flows from this: As this report has stressed, innovation capacity needs to be understood as a systemic capacity. It is critical that innovation support programs are designed and implemented in full cognisance of this systemic nature and the logic that this implies. It is worth reiterating that innovation capacity is: multi scale and multi actor/organisational; it is a dynamic capability built up over time through experimentation and learning and is characterised by unpredictable evolutionary development; institutions (rules, practices, norms and policies) are a key enabler and shaper of innovation capacity; and it is a capacity that supports an innovation agenda that goes beyond R&D and technology commercialisation. Equally important is that key program staff and stakeholders are adequately socialised with the underlying theory of change implied by this understanding of innovation capacity and the logic that links individual program activities with broader program goals and objectives of systemic capacity development.

Choices have consequences and these need to be made transparent: Different program modality choices have impact and resource consequences and trade-offs in terms of long- and short-term results and sustainability of the capacity built. It is important to be transparent about these consequences and trade-offs in negotiations with host country partners and donors. By the same argument, program designers need to be cognisant of the specific dimension(s) of innovation capacity challenges (see Appendix 1 for systems failures) being address in a particular national context, and the selection of a design and underpinning principles appropriate to the task at hand.

Program design needs to be firmly rooted and informed by national contexts: The need for collaborative program design with national partners and strong alignment to policy and development priorities requires a deep understanding of existing modes/national styles of innovation and the specific challenges (but also opportunities) that emanate from it. This implies avoiding normative assumptions about what constitutes an effective innovation system. Instead, it is important to design innovation capacity support aligned to both to national development priorities as well as building on existing patterns and modes of innovation that have emerged in a particular country setting. This has implications for the composition and role governance and program advisory committees as they need to be able to firmly anchor program directions aligned to national innovation priorities and styles, cognisant of a range of contextual issues that shape the national innovation agenda.

Programs with an innovation agenda that is framed by impact aspirations rather than technology offerings gain more policy traction: While new platform technologies present specific technological capability building challenges, for the most part, innovation support needs to be framed by impact challenges that may be agnostic to the forms of knowledge, technology and innovation that are mobilised to address these challenges. However, impact challenges need to be carefully chosen with a realistic scale of ambition, but at a scale of sufficient significance to act as a policy exemplar.

It is important to recognise that innovation is most usually driven by the ability of firms and others to rework the existing stock of knowledge rather than R&D as a source of useful knowledge and the more general: In reality, research and technology commercialisation plays a relatively minor role in innovation in partner countries. More emphasis is needed on supporting existing modes of knowledge acquisition and adaptation. This could be a steppingstone to building industry capability to demand and use knowledge from formal R&D organisations.

Building explicit links between innovation interventions at the firm or community level and the broader policy learning process strengthens the overall national capacity for innovation: In the context of innovation and innovation policy, change involves experiment. A policy experimentation modality supported by evaluation and learning, and explicit policy dialogue processes builds knowledge, capability and confidence and strengthens the overall national capacity for innovation by adapting the policy enabling environment to emerging innovation opportunities and modalities

A focus on building capability in innovation policy evaluation and formulation strengthens policy learning: Innovation capacity building is a long-term, dynamic and evolutionary process rather than a punctuated set-and-forget process. Each new policy is a probe to see how the innovation responds to new stimuli. The ability to evaluate the effectiveness of different policy instruments is critical to a policy learning process that continuously adapts the capacity of the innovation system to current and future impact challenges.

Selecting the right thematic focus helps focus resources and gain policy traction: Giving a thematic bounding to an innovation support program not only concentrates scarce resources, but also helps interventions develop a proof of concept in a specific domain. This gives space to explore innovation capacity issues that span local to national scales, particularly those of an institutional and policy nature. Providing tangible impact results is a way of gaining policy attention that may be required for broader diffusion and scaling of the initiative. Appropriate themes are those framed by development impact challenges, but also those framed by different modes of innovation such as inclusive innovation, responsible innovation or open innovation. However, the latter are likely to have much longer gestation periods.

Bringing in high quality expertise and new ideas helps introduce new ideas about innovation: Successful programs are often those where the calibre and reputation of the international partners has been such that it has introduced radical new ways of thinking about innovation. There is evidence from Vietnam that this has substantially changed the STI policy conversation over the last two decades. A more general point is that innovation support programs have a key role in changing mind sets of critical actors. Designing programs so that there is a creative tension between existing innovation thinking in a country and new ideas brought in from outside aligns with an overall ethos of experimentation and learning in these projects.

Flexibility, process driven, adaptive management approaches, balanced with an impact focus helps programs achieve gaols: The process of innovation capacity building is not a linear one that can be planned and engineered in advance. ToCs and program logics need to be adapted to the experimental nature of the task. At the same time, individual sub-projects on their own are unlikely to make substantial inroads in the innovation capacity building challenge or the impact issues that these are focused on. Taking an active portfolio management approach is thus important in terms of tracking outcomes and impacts at the program level and adapting investments strategies along the way. This implies much greater attention to the MEL process and function it plays within program implementation.

9 Conclusion

In concluding this report, the authors recognise innovation systems and systems support as a growing field of study and practice, and what has perhaps surprised us is that there is so much institutional memory in many of the organisations who have been working in this field – but that it is only in very recent years that people have been documenting their experiences to a greater or lesser degree of success. We have noted in this report the difficulty in evaluating the uncertain and unpredictable pathways for supporting innovation unfolding over extended time frames. Even so, and perhaps because of this, there is a need for a much greater investment in learning and evaluation if the field is to move forward both conceptually and in the delivery and implementation of more effective, sustainable, and impactful programs.

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Appendix 1

Table A.1 Institutional failures family

Parent Domains of failure	Child domains failure	Symptoms	Intervention options	Program modalities / framing
Institutional failures: Hard rules and regulations and soft rules and norms that shape that enable, shape and direct innovation activity	**Hard institutional failures—policy and regulatory environment** Weak policy coordination Ineffective policy framing Poorly developed strategy and vision Weak evaluation of policy implementation Weak or inappropriate governance of STI priority setting and implementation Underdeveloped design and evaluation capabilities to execute the above. **Gaps and missing actors** Weak science/research policy interface Weak or missing policy think tanks Missing innovation coordination agency or function	Weak enabling environment and incentives for innovation, discourages business investment, commercialisation and technology uptake by companies and others Skewed incentives for innovation misdirect innovation away from goals of national development strategies Ineffective/inappropriate policy instruments and strategic choices Perverse STI outcomes from poorly framed STI policies such as FDI, start-ups, etc. Misalignment of STI policy with development aspirations (directionality failures) Restricted policy learning	STI policy analysis and research Foresighting and direction setting exercises, engagement platforms Support to development of IP and other innovation facing regulations and policies Establishment/strengthening of innovation coordination agencies	Policy -oriented: diagnostic and evaluative studies, foresighting exercises, policy research studies and advisory support seeks to improve the formulation of STI policies and policy processes; policy making capacity building programs Multi-level-oriented: STI policy development tackled as part of a wider effort to improve innovation performance in selected industries, sectors or thematic problem sets

	Soft institutional failures – the way 'business is done' Social norms and values, culture, entrepreneurial traditions and patterns of trust and risk averseness within and between organisations and industries restricts the willingness to share resources with other actors needed for innovation. **Gaps and missing actors** Communities of practice to promote learning and change Boundary spanning organisations	Restricted collaboration. Restricted investment in innovation. Skewed or missing incentives for innovation Poorly developed tradition of evaluation and learning. Reduced appetite for change and exploring new ideas and opportunities. Reliance on international trusted sources of technology, rather than domestic R&D providers.	Culture and institutional change through capability development component of other initiatives Pilots that provide "safe spaces" and incentives to experiment with different ways of working and innovating	Embedded focus: Culture and institutional change tackled as part of a wider effort to improve innovation performance in selected industries, sectors or thematic problem sets. Stand alone: capacity building, developing new professional rewards structures

Table A.2 Interaction failures family

Parent Domains of failure	Child domains failure	Symptoms	Intervention options	Program modalities / framing
Interaction failures: The links, interactions and cooperative relationships needed to share knowledge and resources needed for innovation between actors	**Network failures – social capital needed to access and respond to information and knowledge** Insufficient interaction between actors restricts demand signals for innovation and limits access to knowledge and technology **Gaps and missing actors** Missing intermediation functions and organisations. Technical consultants and advisory services Ineffective or missing sector organisation	Lack of relevance and use of research by business, policy and other innovation stakeholders. Restricted demand articulation for research and innovation Limited commercialisation of public research Fragmentation and duplication of R&D Increases search costs for knowledge, resources and partners needed for innovation	Establish/strengthen innovation hubs, platforms & clusters. Facilitate development of university-industry partnerships (grants, challenge funds) Establish/strengthen intermediatory organisations, technology transfer offices, public and private technical advisory services	Problem/challenge focused Sector/industry focused
	Collaboration failures Existing patterns of collaboration lock organisations into narrow or incremental sets of innovation solutions and goals. Restricts the of ideas and demands emerging outside existing interactions. **Gaps and missing actors** Lack of fora to refocus collaboration and innovation on new objectives and missions	Restricts the use of ideas and outside existing interactions Restricts the response to new market, policy and societal demands and aspirations (directionality failure). Reliance on international trusted sources of technology (rather than domestic).	As above, plus: Piloting policy implementation instruments that set new innovation directions (sustainability facing innovation platforms)	

Table A.3 Capability failures family

Parent Domains of failure	Child domains failure	Symptoms	Intervention options	Program modalities/framing
Technological and business capability failures: Knowledge and skills needed to enact innovation.	**Technological capability failures** Lack of technological capability and systems associated with platform technology and access to technology **Gaps and missing actors** Dedicated public and private R&D capability and training facilities Technology service and advisory companies and agencies Regulations to deploy new technology	Limited uptake and spread of new platform technologies	Entrepreneurial development Technological capacity building Commercialisation and business development support	Entrepreneurial-oriented Platform technology-oriented Multi-level-oriented
	Business and entrepreneurial failures Skill to absorb technology, accumulate associated new skills and manage innovation **Gaps and missing actors** Business development and advisory services Technical consultants Opportunities for precompetitive technology learning	Limited commercialisation of public research Limited technology uptake and innovation in SME		

Table A.4 Physical and financial resources failures family

Parent Domains of failure	Child domains failure	Symptoms	Intervention options	Program modalities / framing
Physical and financial resources failures: Infrastructure, equipment, and financial capital needed for innovation	**Infrastructure failures** Weak or missing ICT systems, roads, telecommunication, storage, and other market infrastructure **Gap and missing actors** Insufficient public investment Missing national plans for infrastructure development	Restricts the development of e-commerce related innovation. Inability to deploy industry 4.0 technologies Missing infrastructure unattractive to FDI investors that would other stimulate innovation	Digital transformation road maps Infrastructure master plans Public investment in targeted infrastructure	Policy-oriented, developing infrastructure investment strategies Capacity development program focused on needs assessment and investment planning and evaluation
	Financial failures Lack of financing mechanism for innovation or burdensome administrative or regulatory frameworks to access credit Low risk appetite among investors **Gaps and missing actors** VC and other financial resources need to fuel entrepreneurial ecosystem	Innovators struggle to access resources to finance innovation	Venture capital and impact investment facilitation and support Enterprise challenge funds Innovation prizes	Entrepreneurial-oriented

Table A.5 System failures family

Parent Domains of failure	Child domains failure	Symptoms	Intervention options	Program modalities/framing
Systemic failures that skew the direction of innovation away from national priorities and development goals	**Governance failures** Governance arrangements for setting STI policy priorities and tracking progress do not reflect wider aspiration of society **Gap and missing actors** Missing mechanism for engaging a diversity of societal stakeholder in critical areas of STI discission making such as technology choice, innovation support approaches and impact targets	The direction of innovation can be captured by incumbent interests that are poorly aligned with issues of social inclusion, gender equality, equitable growth and environmental sustainability	Specifically target capacity strengthening on modes and domains of innovation that have high social and environmental relevance, particularly those outside the formal STI arena. Establish multi stakeholder STI dialogue mechanisms that reveal the diversity of innovation process in a country including “hidden” innovation processes that have high social and environmental relevance. Strengthen STI research and policy evaluation capability to explore concerns about the direction of innovation and its impact on social and environmental issues	Innovation process orientated program targeting inclusive for of innovation. Policy orientated programmes that use dialogue and research and evaluation to address issues associated with STI planning, policy and practice.